IMPROVING STRATEGIC MOBILITY:

THE C-17 PROGRAM AND ALTERNATIVES

The Congress of the United States
Congressional Budget Office

NOTES

Unless otherwise specified, all costs are expressed in constant fiscal year 1987 budget authority dollars.

All dates, except those used in an historical context, refer to fiscal years.

Numbers in the tables of this report may not add to totals because of rounding.

PREFACE

In 1981, a Congressionally mandated study of mobility found that the United States lacked adequate means to transport troops and equipment overseas rapidly. Subsequently, the Administration initiated steps to improve U.S. airlift and sealift assets. A near-term improvement plan was approved by the Congress in 1983. In the fiscal year 1987 budget, the Administration has requested funds to begin production of the C-17 aircraft, intended to be the next generation of airlifter, replacing aging C-141s and C-130s. This analysis by the Congressional Budget Office (CBO) examines the Administration's plan to purchase the C-17 and compares it with alternative approaches to improving U.S. strategic mobility. The study was requested by the Senate Committee on Armed Services. In keeping with CBO's mandate to provide objective analysis, this report offers no recommendations.

R. William Thomas of CBO's National Security Division prepared the study under the general supervision of Robert F. Hale and John D. Mayer, Jr. William P. Myers of CBO's Budget Analysis Division performed the cost analysis. The author gratefully acknowledges the assistance of Steven Sheingold and Bonita J. Dombey of CBO and Martin J. Suydam, Jr. of the General Dynamics Corporation. (The assistance of an external reviewer implies no responsibility for the final product, which rests with CBO.) Paul L. Houts edited the manuscript, and G. William Darr prepared it for publication.

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September 1986

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SUMMARY

Strategic mobility is a critical element in U.S. military strategy. For political and economic reasons, the United States cannot maintain adequate forces abroad to meet all of its security commitments. Thus, it must be prepared to meet military aggression by rapidly deploying active and reserve units from their U.S. bases to the area where they are required, be it Europe, the Far East, Southwest Asia, or some unanticipated locale.

Strategic mobility is provided in three ways--airlift, sealift, and prepositioning. *Airlift* is used to move units to combat theaters rapidly. *Sealift,* which has historically moved over 95 percent of cargo during wars, will continue to meet most of the requirement to deploy heavily equipped forces, as well as provide most of the supplies to sustain combat once troops are in position. *Prepositioning* equipment and supplies means to place them in or near potential areas of conflict, thereby reducing the need to transport these items. Military or civilian aircraft would then move troops to the sites where their equipment is waiting.

In 1981, as a result of an overall review of mobility requirements, the Department of Defense (DoD) decided it should have the capability to move 66 million ton-miles per day (MTM/D) by air in the event of future military conflicts. This amount is the goal for strategic or intertheater aircraft that can move cargo over intercontinental distances. In 1983, as a first step to meet this goal, the Administration began to purchase 50 C-5B and 44 KC-10A aircraft. When the last of these aircraft are delivered in 1989, airlift capability will increase from 28.7 MTM/D in fiscal year 1983 to some 48.5 MTM/D, or 73 percent of the long-term goal of 66 MTM/D. The Administration plans to meet that goal by adding 210 new C-17 aircraft to the inventory by the year 2000. The C-17 aircraft offers new capability, but the program for it will require $29.3 billion in procurement and development costs. This Congressional Budget Office (CBO) study analyzes the Administration's plan for meeting mobility needs, with its emphasis on the C-17, and compares it with three alternative approaches that would use existing types of aircraft or ships.

THE ADMINISTRATION'S PLAN FOR STRATEGIC AIRLIFT

As the centerpiece of the Administration's plan, the C-17 would be a modern transport aircraft big enough to carry the largest U.S. military equip-

ment suitable for air transport a distance of 2,400 nautical miles. The Congress has been asked to provide long-lead funding for the first of these aircraft in the 1987 budget.

In addition to buying 210 C-17s, the Administration's plan would retire--and not replace--180 of the oldest C-130 aircraft. The short-range ("intratheater") capability thus lost would be replaced by a new capability of the C-17--namely, it has been designed to land on relatively short runways of 3,000 feet in length, thus permitting it to deliver equipment directly to airfields near the battle zone. For these reasons, the C-17 will modernize the intratheater airlift fleet as well as augment strategic airlift capability.

The Administration also intends to retire 54 existing C-141 transport aircraft and transfer another 80 C-141s to the reserves, reducing their monthly peacetime flying rate in order to extend their service lives (see Summary Table 1).

Effects on Capability

When coupled with the existing fleet and the near-term improvements now being completed, the Administration's plan would provide the United States with a strategic airlift capability equal to 66 MTM/D (for the first month of conflict) by about the year 2000. This capability would be a substantial increase over the 48.5 MTM/D that the near-term improvement program now under way will provide by fiscal year 1989.

In addition to providing strategic capability equal to 66 MTM/D, the Air Force argues that this option would effectively increase intratheater or short-range capability to 16,000 tons per day rather than the 9,000 tons per day available today. That improvement reflects an Air Force assumption that, in addition to the C-17's prime role as a long-distance or strategic airlifter, it would be able to fly cargo close to enemy lines and so augment intratheater capability.

The C-17 would be designed to provide a number of other qualitative improvements. Specifically, the Air Force believes the C-17 would:

- Increase deliveries at busy airfields because, compared with the C-5 aircraft now used for heavy equipment, its smaller size and greater maneuverability would avoid congestion;

- Minimize time spent loading and unloading by the innovations designed in its cargohold;

SUMMARY TABLE 1. DESCRIPTION OF OPTIONS AND THEIR CAPABILITY

Aircraft	Administration's Plan (Buy C-17)	Achieve Capability Earlier (C-5/KC-10)	Buy Less Airlift	Emphasize Prepositioning Instead of Airlift
		Description		
C-17A	210	0	0	0
C-5B	0	70	24	0
KC-10A	0	66	40	0
CRAF a/	10	31	31	0
C-141 Retirements	54	54	54	0
C-130 Retirements	180	180	180	180
C-130H Procurement	0	180	180	180
		Capability		
Strategic or Intertheater (MTM/D) b/	66	66	56	48.5
Year Accomplished	2000	1994	1991	1989
Intratheater (T/D) c/	16,000 d/	9,000	9,000	9,000

SOURCE: Congressional Budget Office.

a. Civil Reserve Air Fleet. The *Airlift Master Plan* would maintain 11.3 MTM/D in CRAF, which implies an addition of 10 wide-body, cargo-capable aircraft to the current fleet.
b. Million ton-miles per day. This widely used measure of capability combines the dimensions of cargo weight and the distance it can be moved in a day.
c. Tons per day.
d. Air Force estimate of the intratheater capability of the combined C-17/C-130 force.

- Reduce the number of required flight crew; its three crew members compare with an average of 5.5 for the C-141 and 6.5 for the C-5;
- Be more fuel-efficient than existing airlifters; and
- Reduce maintenance personnel and costs, thereby making it economical to operate in peacetime.

These are design goals, of course, and not always fully realized in practice. Most of them, however, are based on demonstrated technology. For instance, the engines for the C-17 are already in commercial service in the Boeing 757, and the advanced thrust reverser system was demonstrated in the YC-15 prototype developed in the late 1970s.

Costs

Over the next five years, the Administration's plan would result in investment costs of $10.1 billion. These added dollars would finish developing and begin buying the C-17 aircraft.

Costs over the next five years, however, are only part of the story. Purchase of the C-17 would continue through 1998 for a total investment of $29.3 billion. The United States would also operate the C-17 well into the next century. Thus, an estimate of the long-term operating costs of the C-17 and other aircraft involved in this option becomes important. To capture these effects, CBO has estimated costs to buy and operate the U.S. airlift fleet for the next 30 years. These costs were discounted at a real interest rate of 2 percent a year to be more comparable with current expenditures and are a reasonable guide to long-run costs. The 30-year costs to build and operate the airlift fleet under the Administration's plan amount to $118.1 billion (see Summary Table 2).

ALTERNATIVE I: ACHIEVE CAPABILITY EARLIER

The Administration's plan is not the only way to meet U.S. strategic airlift needs. Instead of developing and buying a new aircraft, the Air Force could continue buying the large C-5B transport and the KC-10 aircraft (a military version of the commercial DC-10), both of which are now in production. The Air Force could also meet some of its airlift requirements through additions to the Civil Reserve Air Fleet (CRAF)--a fleet of commercial aircraft that can be mobilized in a national emergency.

In analyzing Alternative I, CBO assumed the purchase of 70 more C-5B aircraft and 66 more KC-10s, and that 31 Boeing 747 aircraft (or their equivalent) would be added to the CRAF. In addition, to ensure adequate intratheater lift capability for this approach, CBO assumed the purchase of 180 more C-130H aircraft over the 1987-1998 period to replace the older-model C-130s that the Air Force intends to retire (see Summary Table 1).

Effects on Capability

Like the Administration's plan, Alternative I would provide 66 MTM/D of strategic lift capability for the first month of conflict. Indeed, because the C-5 and KC-10 are already in production, it would achieve this capability by 1994--six years sooner than the Administration's plan (see Summary Figure). Moreover, all the aircraft types to be purchased under this option are already operational. Thus, the risk of cost growth or failure to meet perform-

SUMMARY TABLE 2. COSTS OF OPTIONS
(In billions of 1987 dollars)

Option	Five-Year Costs		Thirty-Year Discounted Costs b/
	Investment a/	Total	
Administration Plan (Buy C-17)	10.1	31.0	118.1
Alternative I: Achieve Capability Earlier (Buy C-5/KC-10)	10.9	32.2	114.4
Alternative II: Buy Less Airlift	7.7	29.0	98.5
Alternative III: Emphasize Maritime Prepositioning Instead of Airlift	4.0	24.8	99.7

SOURCE: Congressional Budget Office.

a. Includes costs to develop and buy all new systems except the remaining C-5 and KC-10 aircraft included in the near-term program.
b. Discounted at a real rate of 2 percent a year.

ance goals is minimal. While the C-17 program shows no evidence to date of any significant technical problem, it is a new aircraft and so would present more risk of failure to achieve planned performance.

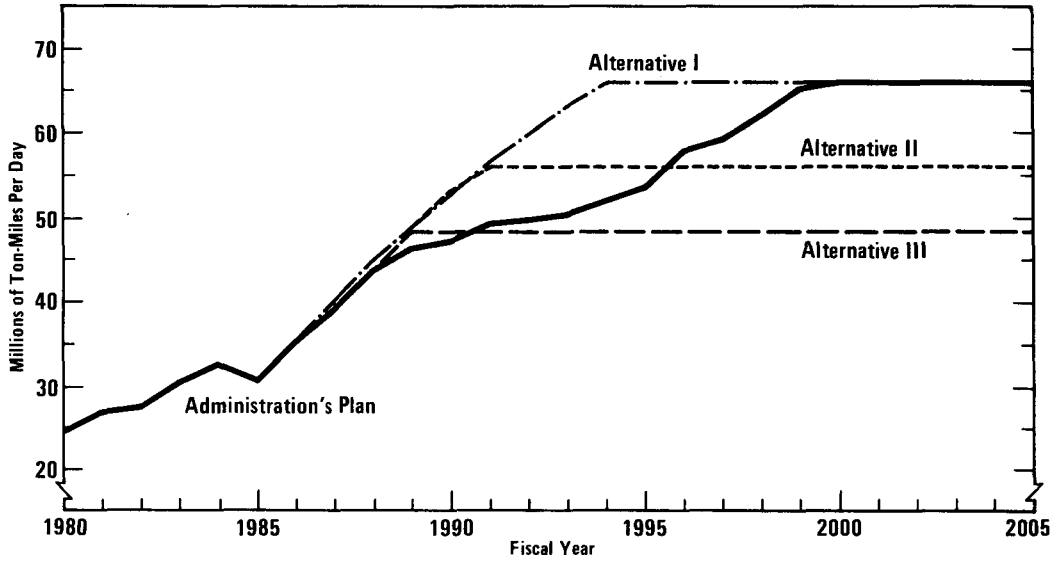
While the Administration's plan and Alternative I provide an equal amount of airlift capability, the C-17 would have a number of qualitative advantages--noted above--that the Air Force believes strongly favor choosing the new plane. In addition, Alternative I might not provide identical capability at shorter or intratheater distances. It would maintain shorter-range or intratheater lift at today's level of about 9,000 tons per day, whereas the Administration's plan would, according to the Air Force, raise that capability to about 16,000 tons per day.

Despite these important differences, the two approaches are similar in their fundamental ability to move cargo long distances. For that reason, a comparison of their costs is revealing.

Costs

Over the next five years, Alternative I would require $0.8 billion more in investment than the Administration's plan, an increase of 8 percent (see

Summary Figure.
Intertheater Airlift Comparison



SOURCES: Congressional Budget Office (for 1987-2005 projections); Department of the Air Force (for 1980-1986 data).

Summary Table 2). This additional investment is needed because the C-5 and KC-10 aircraft are already in production. Thus, funding for additional aircraft must be provided quickly if their production lines are to remain active and efficient. Also, in contrast to the C-17 option, Alternative I would continue the purchase of substantial numbers of C-130 aircraft, which adds $1.5 billion to near-term investment costs.

Nonetheless, when examined in terms of total 30-year costs for acquisition, operation, and support of the airlift fleet, Alternative I is modestly cheaper than the C-17 option, saving $3.7 billion or 3 percent. It is less expensive in the long run because the lower costs of buying aircraft already in production more than offset the operating economies of the C-17. To maintain an adequate supply of trained pilots, however, it might be necessary to operate the C-5 at peacetime rates that are higher than those in current practice, thereby increasing total costs to $120.6 billion--$2.5 billion more than the cost for the C-17 approach.

CBO's comparative costs for the C-17 and the alternative C-5/KC-10 plan differ from the analysis presented by the Air Force in its 1983 study. The Air Force argued that the C-17 approach would be considerably cheaper in the long run. But the Air Force compared the costs of the C-17 with an "all C-5" alternative. CBO assumes that KC-10 and CRAF aircraft--cheaper to buy and operate--would be used to meet less demanding requirements for bulk cargo and "oversize" equipment, reserving the C-5s for heavy equipment. CBO also updated estimates for operation and support, which affected the relative cost of the two approaches, and discounted future costs, although doing so proved to be inconsequential.

ALTERNATIVE II: BUY LESS AIRLIFT

Both short- and long-run cost differences between the C-17 and the C-5/KC-10 approach are not large in percentage terms. If the Congress wishes to achieve large cost reductions, it will have to consider a smaller increase in the size of the strategic airlift fleet. To illustrate the costs of such a plan, CBO analyzed an alternative that would achieve 56 MTM/D rather than the DoD goal of 66 MTM/D for strategic airlift.

With the lower goal, it makes less sense to produce a new aircraft like the C-17. The fixed costs of completing its development and opening its production line would be spread over fewer aircraft, leading to a significant increase in unit cost. Thus, CBO assumed that the reduced goal of 56 MTM/D would be met by buying more C-5 and KC-10 aircraft and that the C-17 program would be canceled. Specifically, CBO assumed the purchase

of 24 additional C-5B aircraft and 40 KC-10 aircraft. Other changes in the airlift fleet are the same as those under the C-5/KC-10 option (Alternative I) discussed above.

Capability would gradually improve under this approach, but would level off at 56 MTM/D in 1991 rather than rising to 66 MTM/D. This lower capability would not meet estimated requirements in a major war, which often greatly exceed even the 66 MTM/D goal. Military commanders would also oppose the lower goal. On the other hand, 56 MTM/D would probably meet requirements in many lesser conflicts, which are also the most likely future wars. Moreover, 56 MTM/D would be a very large airlift capability by historical standards; the United States has never approached airlift capability of that amount in the past. Current military planning emphasizes the need to deploy forces quickly, with little warning time, across the globe. This objective drives airlift requirements to levels never before achieved by the United States.

Costs under Alternative II would, however, be substantially less in the long run. Over the next 30 years, discounted costs would be $19.6 billion or 17 percent less than under the Administration's plan.

Alternative II would also realize a reduction in investment cost over the next five years; over that time period, it would save $2.4 billion or about 24 percent, relative to the Administration's plan. Near-term costs, however, would still be substantial because, if any C-5 and KC-10 aircraft are to be bought, they must be bought soon while production lines are still open.

ALTERNATIVE III: EMPHASIZE MARITIME PREPOSITIONING INSTEAD OF AIRLIFT

If near-term costs are the major issue, the Congress could decide not to make further improvements in U.S. strategic airlift capabilities beyond 1989. Instead, it could make improvements in U.S. prepositioning.

Specifically, Alternative III would cancel the C-17 program and keep airlift capability at 48.5 MTM/D. It would instead place the equipment for an Army mechanized division aboard 12 large maritime prepositioning ships. Moreover, because some equipment and supplies might need to be moved to forward positions by air, this option would also acquire 180 additional C-130 aircraft to maintain intratheater airlift capability at the 9,000 tons per day level currently available.

The effects on costs of substituting these 12 ships for additional strategic airlift would be substantial. Maritime prepositioning ships have been

acquired in the past through a lease/charter arrangement. Five-year costs --covering the lease of needed prepositioning ships and the purchase of C-130 aircraft as well as the acquisition of some of the mechanized division equipment--would equal $4.0 billion, which is 60 percent less than the cost of the Administration's plan. As the ships become available, equipment to be prepositioned aboard them could be taken from other uses. Eventually, the prepositioned equipment would have to be replaced. But the 30-year discounted costs of Alternative III, which include the purchase of all extra equipment, as well as full lease costs, would equal $99.7 billion--or 16 percent below those of the Air Force plan.

Substituting maritime prepositioning for airlift does not, of course, provide equal capability even if the two modes of mobility move the same number of tons in the same overall period of time. Prepositioning ships take longer to get *initial* deliveries to their final destination than aircraft, which can fly high-priority cargo to a spot quickly. But prepositioning may result in faster delivery of the entire division. Indeed, it would take the entire planned C-17 fleet about 18 days to move a mechanized division from the United States to Southwest Asia. By then, a prepositioned division would be in combat deployment. On the other hand, ships cannot go where aircraft can--and this may limit U.S. options. Current tactical aircraft are of little use in deploying forces since they are unable to carry outsize equipment. A prepositioning strategy also requires that planners correctly anticipate where equipment will be needed well in advance of hostilities. Nonetheless, Alternative III illustrates the major cost advantage of prepositioning duplicate equipment rather than buying aircraft to move it.

CONCLUSION

According to CBO's analysis, if the 66 MTM/D goal is to be attained, the differences in costs between the C-17 option and the C-5/KC-10 option are not large. The long-run savings from the latter are at best about 3 percent of costs, well within the range of uncertainty for such long-range projections. The choice between these two approaches probably turns on the qualitative advantages of the C-17's new design versus the more rapid improvements in capability offered by the C-5/KC-10 approach.

Neither of these airlift approaches, however, would greatly reduce spending over the next five years. These costs can only be avoided if the Congress considers--as either a temporary or permanent solution--deferring airlift improvements and relying more on sealift or prepositioning as a cheaper way to position U.S. military forces.